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Spin and Valley Splitting of Two-Dimensional Electrons in Graphene in the High Magnetic Field Limit YUANBO ZHANG, ZHIGANG JIANG, JOSHUA SMALL, Department of Physics, Columbia University, MENINDER PUREWAL, Department of Applied Physics, Columbia University, YAN-WEN TAN, MINA FAZLOLLAHI, JOEL CHUDOW, Department of Physics, Columbia University, JOHN JASZCZAK, Department of Physics, Michigan Technological University, HORST STORMER, PHILIP KIM, Department of Physics, Columbia University — The quantum Hall effect in high quality graphene, a sinlge atomic layer of graphite, is studied in strong magnetic fields up to 45 Tesla. The splitting of Landau levels $n = 0$ and ± 1, caused by the lifting of the spin and valley degeneracies in strong magnetic fields, is observed at T < 5 K. In particular, the quantum Hall state $\nu = \pm 4$ is found to arise from the spin splitting of Landau level n $= \pm 1$. The effective Lande g-factor measured at this state is close to 2. The spin origin of $\nu = \pm 4$ is further confirmed in magnetotransport experiments performed in the presence of an in-plane magnetic field. While the exact origin of the valley degeneracy lifting is not yet clear, we propose several possibilities.

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